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JAPANESE PATENT OFFICE -- Patent Abstracts of Japan

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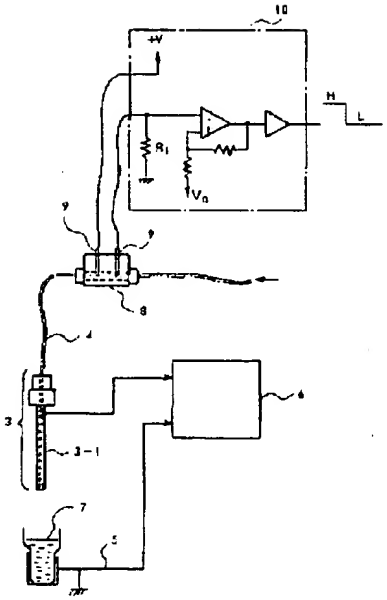
Applicant: HITACHI LTD
Inventor: INAGAKI AKIRA

AUTOMATIC ANALYZING DEVICE

Abstract:

PROBLEM TO BE SOLVED: To prevent an error in analysis data due to a malfunction in detecting the liquid level.

SOLUTION: Plural electrodes 9 are disposed in a piping connected to a probe 3, and the electric conductivity of wash water is measured by the electrodes 9. According to the measured value, if the wash water reaches such a conductivity as to have an effect upon the capacitance type liquid level detection, an alarm is given to request replacement of washing water and washing in the piping, or the replacement of wash water and washing in the piping are automatically performed by a computer in the device.



Laid-Open Official Gazette
Laid-Open Patent Hei 9-127131 (Laid-Open: May 16, 1997)
Applicant: Kabushiki Kaisha Hitachi Seisakusho

【Claims】

【Claim 1】

An automatic analyzing device detecting a liquid level by determining electrostatic capacitance change between a probe and a liquid surface comprising:

a means of measuring electric conductivity of washing liquid in a piping connected to the probe with electrodes installed inside the piping connected to said probe which takes samples or reagents; and,

a means of determining degradation of washing water based on the measured values of the electric conductivity of the washing water.

【Detailed Description of the Invention】

【0001】

【Technical Field to which the Invention belongs】

The present invention relates to an automatic analyzing device having liquid level detector used for automatic chemical analysis of various liquids including blood and the like.

【0002】

【Prior Arts】

As described in Laid-Open Patent Sho 64-41823, analysis is performed with fractional sampling dispensation of small amounts of reagents or samples such as blood in chemical analysis. This fractional sampling is done by sucking a predetermined amount of samples with a nozzle called probe and discharging in a reaction section.

【0003】

Generally in the fractional sampling, the probe descends and sucks a sample in the state that the tip of probe enters beneath the liquid surface, and in case if the probe enters too deep down the liquid surface, the liquid will adhere to the probe, which causes not only decrease in the accuracy of the amount of fractional sampling but also degradation of the accuracy of analysis due to mixing of the liquid adhering to outside wall of the probe to the other liquid, consequently the downward movement of the probe must stop when the probe tip contacts the liquid surface.

【0004】

After sucking and discharging reagents or samples such as blood serum, the

probe is generally washed with flowing washing liquid (such as purified water) from a tube attached to an upper section of the probe and discharging the liquid from the tip of the probe. However in case the electric conductivity of the washing water is as high as that of a tap water and the like, signal changes are detected as if the probe contacts the liquid surface because of electric conductivity changes between the probe and an opposed electrode due to the tube change accompanied by an up-and-down movement of the probe. Such signal changes pose a significant problem to accurate liquid level detection.

【0005】

In Laid-Open Patent Sho 64-41823, liquid level detection methods regarding subject matter with a liquid subject to fractional sampling having a large dielectric constant and those having small one are described, however there is no description about influence of above-said washing liquid in a tube connected to the probe.

【0006】

【Problems the Invention intends to solve】

In Laid-Open Patent Sho 64-41823, there is no reference to the electric capacitance change between the probe and the opposed electrode due to the tube movement during up-and-down movement of the probe when electric conductivity of washing water in the tube attached to the upper section of the probe for washing inside the probe and probe tip is raised because of breeding of such as microorganisms. However such a capacitance change is a significant problem to detect surely the liquid surface.

【0007】

Consequently it is necessary to replace the washing water or to change the washing liquid in the tube in case the electric conductivity of the washing water in the tube exceeds a certain level.

【0008】

The subject matter of this invention is to monitor the degradation of washing liquid.

【0009】

【Means to solve the problems】

In the present invention to solve above-said problems, setting a plurality of electrodes in the piping connected to the probe, measuring the electric conductivity of washing water with said electrodes, warning based on the measured data when the conductivity of the washing water exceeds a certain level which electrostatic capacitance liquid level detection is influenced for demanding change of the washing

water and cleaning of inside the piping or automatically changing the washing water and cleaning inside the piping via computer in the device.

【0010】

That is, using above-said means, analysis data errors due to malfunction of liquid surface detection is prevented beforehand by stopping analysis and changing washing water when the electric conductivity of washing water in the tube connected to the probe exceeds a predetermined value.

【0011】

【Form of carrying out the Invention】

The present invention will be described referring to an example.

【0012】

The automatic analyzing device has a probe section 3 for fractional sampling of sample 1 such as blood serum and a reagent 2 as shown in Figure 2. The probe section 3 can move along the X direction and Z direction. Further in the probe section 3, washing water for washing inside the probe 3-1 and the probe tip is introduced through tube 4 connected to the upper section of the probe 3-1 and discharged from the tip of probe 3-1.

【0013】

In automatic analyzer for blood or the like, generally a nozzle called as a probe 3-1 is used for fractional sampling in small amount of samples such as blood and blood serum in test tubes or the like.

【0014】

A liquid surface detection function is installed to prevent excessive immersion of prove 3-1 down under the liquid surface in fractional sampling of samples and reagents.

【0015】

The liquid level detection function is to stop downward movement of the probe 3-1 when the probe 3-1 reaches the liquid surface, and it is a function to prevent not only lowering of the accuracy of the amount of fractional sampling caused by unnecessary liquid adhesion to the probe 3-1 but also contamination of the liquid added to the other liquid.

【0016】

There are various methods for liquid level detection, the electric capacitance method among them is a method to detect a liquid surface by measuring capacitance change formed between the probe 3-1 and the opposed electrode 5 using the electrostatic capacitance detection circuit 6.

【0017】

The capacitance significantly changes in normal state, as shown in Figure 3(a) because the electric potential of the whole liquid becomes the same as that of probe 3-1 by moving the probe 3-1 downwardly and contacting to the liquid surface 7. However in case the conductivity of washing water in the tube 4 connected to the probe 3-1 is large, as shown in Figure 3(b), the electrostatic capacitance changes between the opposed electrode 5 and the liquid in the tube of which electric potential becomes the same as that of the probe 3-1 because of the tube change caused by a movement of the tube corresponding to the downward probe movement in the fractional sampling.

【0018】

Therefore it is impossible to determine correctly that the capacitance change is whether because of the contact of the probe 3-1 with the liquid surface or because of the shape change of the tube 4.

【0019】

Thus to adopt the electrostatic capacitance liquid level detection method, washing water having electric conductivity lower than 20 μS/cm must be used because the tube 4 filled with washing water must be insulated. However even if using a washing water originally lower than 20 μS/cm, the electric conductivity of washing water may become higher than 100 μS/cm because of breeding of microorganisms or the like.

【0020】

Consequently the inventor has attained the present invention of the method where change of washing water and clean-up of piping are demanded by measuring electroconductivity of the washing water and alarming based on the measured values when electric conductivity of washing water becomes higher than the level electrostatic capacitance liquid surface detection is influenced. Or automatically washing water change and clean-up in the piping are performed. Followings are the description of a working example.

【0021】

Regarding a method of measuring electric conductivity of washing water, although a method may be adopted where more than two electrodes are set in the tube and the electric conductivity is measured from the current between the electrodes, it is actually difficult to install electrodes inside the tube.

【0022】

However it is usual to use block 8 for connection at fastening point in the

piping of tube 4 connecting to the probe 3-1 as shown in Figure 1. Thus by setting more than two electrodes 9 in the block, the electric conductivity may be measured based on the electric current passing through the electrodes.

【0023】

In an example of a measuring circuit, an electric voltage of resistor R1 is compared with a reference voltage V0 by connecting the electrode 9 and the resistor R1 in series as shown by electric conductivity determination circuit 10 in Figure 1. When lowering the electric conductivity of the washing water in the block 8, the voltage appearing in the resistor R1 increases and when the voltage exceeds the reference voltage V0, the output of the determination circuit 10 turns from H to L. Although not illustrated in the drawings, a computer, which controls the probe 3-1 or the analyzer, obtains this signal and by alarm demands the washing water change and clean-up in the piping or automatically performs washing water change and clean-up in the piping.

【0024】

【Effects of the Invention】

Thus by measuring the electric conductivity of washing water of the automatic analyzing device, when the electric conductivity of the washing water in the tube 3-1 exceeds a predetermined value, the analysis is stopped and washing water is changed, thereby prevention from occurring of errors of analysis data caused by malfunction of liquid surface detection becomes possible.

【Brief Description of Drawings】

【Figure 1】 An illustrative view of an automatic analyzing device of an example of this invention.

【Figure 2】 An illustrative view of positional relationship of samples, reagents and probe section of an analyzing device of an example of this invention.

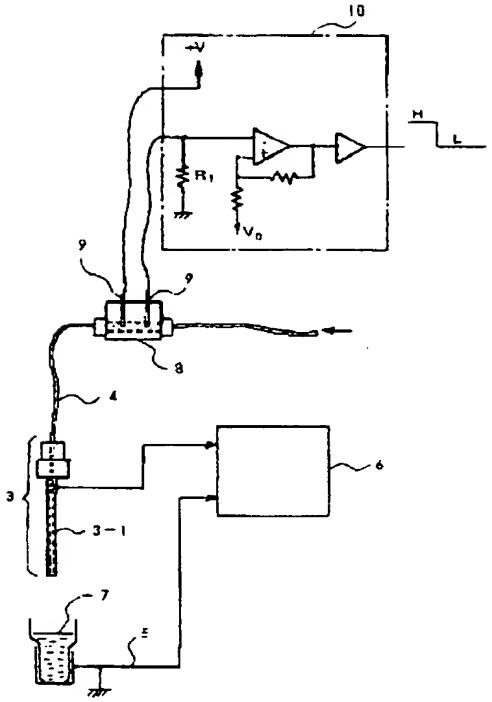
【Figure 3】 Drawings showing characteristic curves of output changes of the electrostatic capacitance detection circuit.

【Description of Symbols】

1•••samples, 2•••reagents, 3•••probe section, 4•••tube, 5•••opposed electrode, 6••• electrostatic capacitance detection circuit, 7•••liquid surface, 8•••block, 9••• electrodes, 10•••electric conductivity determination circuit.

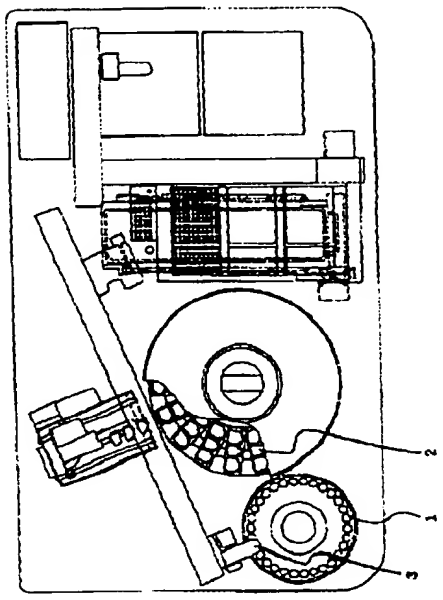
【Fig. 1】

Fig. 1



【Fig. 2】

Fig. 2



【Fig. 3】

Fig. 3